Explaining the Understand-Know-Do (UKD) structure of Te Mātaiaho the refreshed New Zealand Curriculum

Graeme Aitken Bronwyn Wood

May 2023

Contents

Executive Summary	3
Background to development of the UKD Structure	3
Distinguishing features of Learning Area (Mātaiaho) structure	6
Purpose	8
Understand	8
Know	11
Do	12
In a nutshell	14
References	15

Executive Summary

This paper outlines the background to the New Zealand Curriculum Refresh and in particular the structure of the learning areas. It explains some of the reasons why a curriculum refresh was needed and describes how the Understand – Know – Do [UKD] structure was developed. It gives further explanation about how this structure is understood and enacted within the curriculum refresh.

Background to development of the UKD Structure

While the 2007 NZ Curriculum enjoyed strong support in schools, concerns began to arise about the 'openness' of this curriculum and its lack of guidance around content choice. In 2019, The Curriculum, Progress and Achievement Ministerial Advisory Group [CPAG] highlighted concerns about a lack of coherency of coverage of key learning within the New Zealand Curriculum which meant that some students were missing out on learning that is important to them and their communities.¹ They identified that the curriculum did not clearly signal which learning all students were entitled to and therefore, students frequently had reduced access to the full scope of learning areas. In addition, the focus of learning was at times directed by the key competencies (the 'frontend' of the curriculum) at the expense of learning area coverage (the 'back-end' of the curriculum), and that there were few signals or markers of progression within learning areas (Crown, 2019). Their findings were confirmed by academic research in New Zealand which also identified that the openness of the NZC was reducing future pathways for students beyond school (further exacerbated by NCEA's 'flexibility').²

In addition, concerns were also raised about the lack of attention paid to the value of Matauranga Māori knowledge in the curriculum despite the status of the Treaty of Waitangi / Te Tiriti o Waitangi and the requirement for schools to 'consult with Māori and ensure their plans, policies and local curriculum reflect local tikanga Māori, mātauranga Māori and te ao Māori'. The lack of Aotearoa New Zealand history teaching, always a concern of Māori, was publicly raised by parliamentary petitions from Ōtorohanga College students in 2015 and by the New Zealand History Teachers

https://www.legislation.govt.nz/act/public/2020/0038/latest/LMS280244.html?search=sw 096be8ed81d95f3
4 curriculum 25 se&p=1&sr=1

¹ Crown. (2019). Curriculum, Progress and Achievement Ministerial Advisory Group Background Paper: Clarify pathways for ākonga (student progress).

² Johnston, M., Wood, B. E., Cherrington, S., Boniface, S., & Mortlock, A. (2022). Representations of disciplinary knowledge in assessment: Associations between high school and university assessments in science, mathematics and the humanities and predictors of success. *Educational Assessment*, 1-21; Priestley, M., & Sinnema, C. (2014). Downgraded curriculum? An analysis of knowledge in new curricula in Scotland and New Zealand. *The Curriculum Journal*, 25(1), 50-75.; Sinnema, C. (2015). The ebb and flow of curricular autonomy: Balance between local freedom and national prescription in curricula. In D. Wyse, L. Hayward, & J. Pandya (Eds.), *The Sage Handbook of Curriculum, Pedagogy and Assessment*. London: Sage; Wilson, A., & McNaughton, S. (2014). Using selected NCEA standards to profile senior students' subject-area literacy. *Set: research information for teachers (Wellington)*(2); Wood, B. E., & Sheehan, M. (2021). Transformative disciplinary learning in history and social studies: Lessons from a high autonomy curriculum in New Zealand. *The Curriculum Journal*, 32(3), 495-509.

³ The Education and Training Act amendments (2020)

Association in 2019. This also highlighted the lack of curriculum coherence across New Zealand schools because of the open New Zealand curriculum which allowed considerable teacher autonomy.

The priority on competencies and skills (as outlined in DeSeCo, (OECD, 2005⁴) which had been adopted in the NZC was also revisited considering the 2019, **OECD Learning Compass 2030**⁵ which suggested a reprioritisation of disciplinary knowledge. As a result of these factors, there was considerable impetus by 2019 to begin to examine some of these weaknesses in the NZC and explore some options. In 2019, a group was tasked with providing some initial advice on how to increase curriculum coherence, integrate procedural and substantive knowledge, to identify 'learning that can't be left to chance' as well as paying greater attention to student progression. Four potential approaches to curriculum organisation were examined.

- 1. **Threshold concepts:** Threshold concepts are concepts which are held to be central to the mastery of a discipline but are (at least initially) difficult to understand. Proponents argue that once understood, threshold concepts hold potential to open up new and transformative understandings for learners.⁶ While they hold potential to refine and focus learning, they have proven difficult to define and implement, do not speak powerfully beyond the technical area within which they originate,⁷ provide little support for progression and have almost exclusively been applied in tertiary educational contexts.⁸ Threshold concepts therefore were not deemed to be a key strategy, but they alerted the group to the importance of identifying conceptual ideas within disciplinary areas.
- 2. **Disciplinary-specific approaches:** Disciplinary-specific approaches prioritise knowledge derived from disciplines, thus linking school to higher education more tightly, generally with greater prescription along discipline-based lines. Most curricula derive from discipline-informed approaches to some extent, however, there is a continuum within this approach with more traditional notions of disciplinary knowledge at one end (i.e. preserving the 'canon' of knowledge), and more liberal ideas at the other (the evolving nature of disciplines). A disciplinary approach is generally clear to communicate, easy to resource and to develop progression markers and can reduce teacher workloads. It also can reduce teacher autonomy and agency and be less responsive to students' and community's interests and needs. Disciplinary approaches

⁴ OECD. (2005). The definition and selection of key competencies: Executive summary. Paris: OECD

⁵ OECD. (2019). *Learning Compass 2030*.

⁶ Meyer, J., & Land, R. (2003). Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practising within the disciplines. In C. Rust (Ed.), *Improving student learning - Ten years on*. Oxford: OCSLD. Meyer, J., Land, R., & Baillie, C. (2010). *Threshold Concepts and transformational learning*: Brill.

⁷ Perkins, D. N. (2014). *Future wise: Educating our children for a changing world* (First ed. ed.). San Francisco, CA: Jossey-Bass & Pfeiffer Imprints, Wiley.

⁸ Barradell, S. (2013). The identification of threshold concepts: a review of theoretical complexities and methodological challenges. *Higher Education*, *65*(2), 265-276. doi:10.1007/s10734-012-9542-3

remain important for the NZC Refresh alongside an agility around teacher decision-making to incorporate ideas important to communities.

- 3. **Concept-led approaches**: Concepts are higher order or abstract ideas that embody a set of ideas. When used in curriculum design they provide a way to sift, sort and integrate information through a focus that 'teaches beyond the facts' by working toward bigger (conceptual) understandings. Concept-led approaches provide a way to sift and sort through the large number of 'facts' students need to know as it gives educators a tool to organise and collate important ideas and are used in many disciplines. Conceptual understandings can also be 'big' ideas, or another way of putting that is that 'big ideas' can be developed in rich conceptual ways (many of the 2007 achievement objectives could be described as conceptual understandings). However, research shows that teachers are not always good at drawing out the key conceptual understandings in a topic and the level of conceptual complexity in some curricula are not always well translated in the classroom. They continue to be a useful approach to organising curriculum ideas in the New Zealand Curriculum Refresh.
- 4. **Big ideas:** 'Big ideas' holds together a cluster of ideas that are more than facts, definitions or concepts. They can provide an organising framework for curriculum design and pedagogy by providing the 'conceptual velcro' of a topic by bridging discrete knowledge and skills to form a larger intellectual frame (Wiggins & McTighe, 2005, p. 6). They can provide focused learning towards a named understanding or goal and are flexible to develop. However, they have been challenging to develop (who decides on what is a 'big idea?') and don't in themselves provide indicators of progression. They hold some potential for identifying the 'learning that cannot be left to chance' in a learning area. David Perkin's¹¹ work on 'lifeworthy' knowledge is helpful to reinforce the idea of enduring understandings. Perkins describes such knowledge as big understandings and big questions that are "big in the lives learners are likely to live." Big ideas resonated with the aim of identifying learning that could not be left to chance and so this was developed further within the NZ Refresh and underpins the UKD structure.

At the same time, other work was undertaken to explore the organisation of national curricula. For example, the **Welsh curriculum** had identified statements of 'what

https://doi.org/10.1080/00220270903494287

⁹ Erickson, H. L. (2002). *Concept-based curriculum and instruction: Teaching beyond the facts*. Thousand Oaks: Corwin Press Inc.; Stern, J., Ferraro, K., & Mohnkern, J. (2017). What are the essential elements of concept-based curriculum design? In J. Stern, K. Ferraro, & J. Mohnker (Eds.), *Tools for teaching conceptual understanding, secondary: Designing lessons and assessments for deep learning* (pp. 9-28). Retrieved from https://us.corwin.com/sites/default/files/upm-assets/82739_book_item_82739.pdf ¹⁰ Milligan, A., & Wood, B. (2010, 2010/08/01). Conceptual understandings as transition points: making sense of a complex social world. *Journal of Curriculum Studies*, *42*(4), 487-501.

¹¹ Perkins, D. N. 2014, ibid

¹² Perkins, 2014, ibid, p230

matters' ('big' ideas and key principles in each area) and 'principles of progression' ¹³ (Hwb, 2022). The Know-Do-Understand model from the **British Columbia Curriculum** was also influential. This curriculum was implemented in 2018 and proposed a Know-Do-Understand" model to support a concept-based competency-driven approach to learning. ¹⁴ It proposes that the three elements, the Content (Know), Curricular Competencies (Do), and Big Ideas (Understand) all work together to support deeper learning. These ideas were influential in shaping up New Zealand's Understand – Know – Do model [UKD], although some changes in how these terms were understood and defined were made.

A further influence on the thinking behind the UKD structure was the work of the International Educational Assessment Network (IEAN) and their observation that learning progressions in curriculum should be based on big ideas (what matters) and include content/knowledge and skills/competencies.¹⁵

Distinguishing features of Learning Area (Mātaiaho) structure

Learning areas are retained in the New Zealand Curriculum Refresh because these reflect distinct forms of substantive knowledge and procedural skills sourced in disciplinary traditions, and as such contain the building blocks for learning ¹⁶. Each Learning Area comprises a statement of Overall Purpose and an organisation of content within a common Understand, Know, Do (UKD) structure. This structure was settled on for two main reasons:

It aligns with one of the fundamental processes of learning, viz. the building of schema - the grouping together of associated information in long term memory. As Graham Nuthall¹⁷ showed in the context of Aotearoa New Zealand classrooms, learning is not a 'one shot' event, rather it is a sequence of experiences each one building on the previous one with the sequence aimed at developing enduring and transferable understandings. Naming these expected understandings in a learning area is helpful because it provides direction, but it is insufficient without naming the sources of developing those understandings – the working together of practices (Do) with knowledge (Know). Nuthall found that students need the accumulation of at least three sets of experiences to build their schema – in other words, to make sufficient connections to secure an understanding. The Know element contributes the *schema-building content* and the Do element the *schema-building practices* that enable ākonga to progressively broaden and deepen their understanding.

¹³ Hwb. (2022). Introduction to Curriculum for Wales guidance: https://hwb.gov.wales/curriculum-forwales/introduction

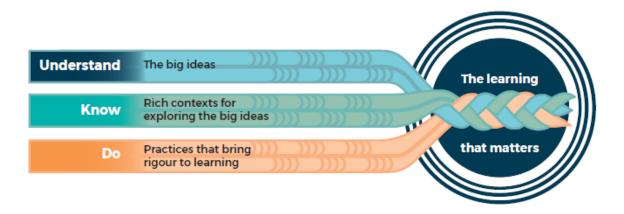
¹⁴ British Colombia Curriculum https://curriculum.gov.bc.ca/curriculum/overview

¹⁵ IEAN. (2020). *Policy Conversation Paper Learning Progression: Implications for Curriculum & Assessment*. Retrieved from <u>iean-learner-progression-implications-dec2020v2.pdf</u>

¹⁶ Hirst, Paul (1974) Knowledge and the Curriculum. London. Routledge and Kegan Paul; and Phenix, Philip (1964). Realms of Meaning. New York, McGraw Hill.

¹⁷ Nuthall's work is extensively reported but it is most succinctly summarised in his final work: Nuthall, Graham (2007). *The Hidden Lives of Learners*. Wellington, NZCER Press.

It represents the entitlement to learning within each learning area as *more than* abstract understandings, *more than* the accumulation of knowledge, and *more* than the development of competencies, processes, and skills. It is from the interconnectedness among these elements that the richest learning occurs – important practices (Do) tied to significant content (Know) in the service of developing enduring and transferable understandings (Understand). It is the understandings, developed in these rich ways, that in the end enable students to act and to make a difference in the world.



Turning now to the specific contribution of each element within the structure of the Learning Area.

Purpose

Simply put, the **Purpose** is a succinct statement of the *distinctive* 'gift' that the learning area offers ākonga. In other words, the **entitlement** to learning (both content and practice) ākonga would be deprived of if they did not have opportunity to engage with the learning area.

It expresses the **underlying aims** and **nature of learning** in the learning area including the nature of learning that arises from **Te Tiriti o Waitangi partnership** and our **location in the South Pacific.**

Each learning areas has been designed to support the vision of Mātaitipu and provides four kinds of value for students to ensure they can thrive¹⁸:

- 1. personal: personal enjoyment, satisfaction, and everyday use of learning
- 2. *participatory*: participation in society in respectful, authentic, and meaningful ways
- 3. pathway: creating pathways into further study and/or into the uncertain landscape of work in order to secure their own standard of living and to contribute to a sustainable economy
- 4. *planetary*: living sustainably and with global confidence through knowing about the world how its physical, cultural, economic, environmental, and social systems work.

Understand

The Understand element describes the **deep and enduring big ideas**, including ideas relevant to **mātauranga Māori**, that we want students to **take away and remember** from their experiences in the learning area. In student language, they flow from the stem:

'I am deepening my understanding that...'

They are **few in number** and capture the **substantive** ideas that organise and connect information and experiences. They are **understandings of the learning area**, not the understandings about the learning area that are addressed in the Purpose Statement. As such they **transcend** the multiple contexts or strands within the learning area, binding together knowledge and skills to form a larger **intellectual**

¹⁸ Based on Hannon, Valerie & Peterson, Amelia (2021) *Thive: The Purpose of Schools in a Changing World*. Cambridge University Press.

frame.¹⁹ They are a **key point of reference for planning** and are likely to be **present in many or most topics** related to a learning area.

They are not directly assessed but are deepened and made more memorable as students engage with the Know and Do elements. As Harlen notes, at each phase the aim is to move a little further towards a big idea, not to try to forge (and assess) a link between every learning experience and the most sophisticated form of the idea.²⁰

It is by no means a straightforward process to decide on the big ideas, nor to confine them to a small enough number to be memorable.

Others have suggested criteria that might be useful. For Perkins²¹, ideas are big in four ways:

- **Big in insight** understandings that move learners forward in life content that reveals something with life significance, practical or intellectual, about the physical, social, political, financial or any other side of the world.
- **Big in action** understandings that inform action, for example, making professional and political choices, managing interpersonal relationships, formulating plans, engaging in the arts, and pursuing intellectual interests.
- **Big in ethics** understandings that shape ethical judgements and decisions around personal, interpersonal, civic and global matters.
- **Big in opportunity** understandings that will likely come up often important contexts.

In the context of science, Harlen²² recommends that the selection of big ideas should be guided by four criteria - namely, they should:

- have *explanatory power* in relation to a large number of objects, events and phenomena that are encountered by students in their lives during and after their school years;
- provide a basis for *understanding issues*, such as the use of energy, involved in making decisions that affect learners' own and others' health and wellbeing and the environment;
- lead to *enjoyment and satisfaction* in being able to answer or find answers to the kinds of questions that people ask about themselves and the natural world;

¹⁹ Wiggins, Grant & McTighe, Jay (2005). Understanding by Design (Expanded 2nd Edition). Upper Saddle River: Pearson, p 7

²⁰ Harlen, W. et al (2015). Working with the Big Ideas of Science Education. <u>IAP: The Global Network of Science Academies</u>. p19

²¹ Perkins, David N. (2014). *Future Wise: Educating Our Children for a Changing World*. San Francisco, Jossey-Bass. p230

²² Harlen, W. (2015). Towards big ideas of science education. *School Science Review*, 97(359), 97–107.

have *cultural significance* – for instance, in affecting views of the human condition
 reflecting achievements in the history of science, inspiration from the study of nature and the impacts of human activity on the environment.

McTighe and Wiggins²³ arrive at the components of understanding by considering what it means to truly understand. For them, a person understands when they can:

- *Explain*: provide thorough, supported and justifiable accounts of phenomena, facts and data;
- *Interpret*: tell meaningful stories, offer apt translations; provide a personal dimension to ideas and events; make them personal or accessible to others;
- *Apply*: effectively use and adapt knowledge in diverse contexts;
- *Have perspective*: see points of view through a critical lens; see the big picture;
- *Empathize*: find value in what others may see differently; perceive sensitively;
- Have self-knowledge: perceive the personal style, prejudices, projections and habits
 of mind that both shape and impede their own understanding; awareness of what
 they don't understand, of what understanding is hard, and how you come to
 understand.

If we distil the essence of each of these and contextualise them within a refreshed New Zealand Curriculum, the following criteria help guide the selection of Understand statements. Taken together as a set the Understands should:

- 1. direct attention to *mātauranga Māori* i.e. to a distinctive body of knowledge and awareness held by Māori (reo: language, ahurea: culture, tuakiritanga: identity).
- 2. have *explanatory power* central to the learning area i.e. capture understandings (declarative/'knowing that'; epistemic/'knowing why') that lie at the heart of the learning area.
- 3. *have depth* i.e. can be developed with increasing complexity from the earliest years at school.
- 4. *connect learning* across the learning area i.e. be conceptually based and transferable to multiple contexts and circumstances.
- 5. have *lasting value* i.e. it is important to remember beyond school long after details may have been forgotten.
- 6. be of life *significance* i.e. of aesthetic, historic, scientific, social, physical, environmental, cultural or spiritual value that will be relevant to students in their lives during and after their school years
- 7. *inform ethical judgement*, decision-making and/or action.

 $^{^{23}}$ McTighe, Jay & Wiggins, Grant (1999). The Understanding by Design Handbook. Alexandria, VA., ASCD. $\rm p10$

Know

This element comprises the **meaningful and important knowledge** (concepts, generalisations, explanations, and stories) that exemplifies and enriches the understandings. In student language, this most commonly flows from the stem:

'I know...'

The Know element is organised within groupings that associate related information together in coherent and meaningful ways through a context. It makes visible knowledge deriving from **mātauranga Māori**.

The selection of knowledge is not guided by coverage. Rather it is selected to ensure students have time to consolidate **what is most important for ākonga to know** and to draw on to progressively deepen and broaden their understanding of the big ideas.

The Know statements identify content that is central to the learning area. They are grouped based on the ways of organising knowledge in the domain and the clusters of content that are central to the learning area (sometimes organised through 'strands' as in the 2007 New Zealand Curriculum). Topics draw from within and across these groupings and are selected to optimise relevance to students and opportunities for them to make rich connections between information to form concepts. Conceptual depth is built when teachers revisit concepts beyond one topic and when students learn to understand the relationship between concepts and express these as generalisations, and to be able to transfer these to new contexts²⁴. The enduring understandings (Understand) build incrementally from multiple engagements with the Knowledge strands. For this reason, and because of the constraints of time, the Knowledge strands identify that which is *relatively most important to Know*, rather than all that could be known.

Distinguishing between Understand and Know

Because the Know element comprises concepts and generalisations it is sometimes confusing to distinguish between Understand and Know. At the most fundamental level the difference is one of degree with the Understand big ideas holding greater depth (and therefore requiring rich, ongoing revisiting) and having greater transfer both across and beyond the learning area.

.

²⁴ Stern. ibid

Perkins defines this as the distinction between 'big' and 'niche' understanding. Using his criteria for 'big understandings', Perkins²⁵ contrasts two examples to illustrate the distinction. He argues that **Energy** is a Big Understanding because it is big in *insight* (it offers fundamental insights about how the world works), big in *action* (it informs actions we can take such as pursuing innovations and developing policies that support innovation), big in *ethics* (it poses ethical considerations about energy use and energy resources), and it is big in *opportunity* (we have alarmingly frequent opportunities to think about energy and energy use).

On the other hand, **quadratic equations** while clearly important in the discipline of mathematics are more of a niche understanding. They are big in *insight* (contributing fundamentally to technical understandings of mathematics), and big in *action* (equipping learners to solve certain kinds of problems) but they make little contribution to *ethics* or *opportunity* (other than as acquaintance knowledge).

In our framing, Energy sits at the level of an Understanding with broad transfer and opportunities for multiple revisiting; quadratic equations are a Know as part of the Algebra knowledge strand.

<u>Do</u>

Do is the **performance**²⁶ element of understanding. In student language, it flows from the stem:

'I can...'

It describes the groupings of **practices, strategies, skills and competencies,** including those that derive from **mātauranga Māori,** that are **particular to the learning area** and that bring **rigour to learning.** As learners use these practices to progress their knowledge and understanding they become more sophisticated in their use and shift to thinking and acting as 'experts' within the learning areas. The practices also supports learners to connect, transfer and apply learning to meaningful contexts.

The Do element draws attention to procedural approaches and the relationship between competencies, skills and content. The Key Competencies (Thinking, Using language, symbols, and texts, Managing self, Relating to others, Participating and contributing) are not content-free. They are developed through their use *with content*. So, they are used as students explore the Know and Understand elements of the

²⁵ Perkins, ibid, p 54-56

²⁶ Wiggins & McTighe, ibid, p7

curriculum. Because of their association with knowledge, and because the nature of knowledge varies between learning areas, **competencies and skills are embedded within the Do element of each learning area**. Their application and expression reflect the particularities of the learning area. For example, because it is underpinned by deep, abstract structures that relate to a disciplinary field, critical thinking is not a generally transferable competency.²⁷ Rather critical thinking **operates within domains and varies according to the domain.** Willingham illustrates this with an example:

Wanting students to be able to 'analyse, synthesise and evaluate' information sounds like a reasonable goal. But analysis, synthesis and evaluation mean different things in different disciplines. Literary criticism has its own internal logic, its norms for what constitutes good evidence and a valid argument. These norms differ from those found in mathematics, for example. And indeed, different domains – science and history, say – have different definitions of what it means to 'know' something. Thus, our goals for student critical thinking must be domain specific. An overarching principle like 'think logically' is not a useful goal. (p6)

For the reasons listed above it is best to think of the Do elements as the *practices* that represent the *distinctive* contribution of the learning area and bring rigour to learning. So, following from Willingham's comment above, in Social Sciences, critical thinking is qualified by its context: 'Thinking Critically **about the Past**' and is elaborated as:

Constructing narratives about the past helps to sequence events and identify historical relationships. Narratives about historical experiences may differ depending on who is telling the story. Judgements about past experiences, decisions, and actions need to take account of the attitudes and values of the time and people's predicaments and points of view. By critiquing these interpretations and reflecting on our own values, we can make evidence-based, ethical judgements about the past.

Place of literacy and numeracy

Literacy and numeracy are essential for students to be able to access and use knowledge. The Ministry of Education *Literacy & Communication and Maths Strategy*²⁸ distinguishes between generic and subject-specific literacy and numeracy.

The critical foundations of literacy and numeracy that are necessary for students to secure success across all progress outcomes are described in English and mathematics & statistics learning areas. The generic literacy and numeracy are developed as students engage with content across the full Understand-Know-Do range in each learning area. Each learning area incorporates within the Do element those specialist literacy and numeracy practices with which students need to become fluent in that particular learning.

²⁷ See Willingham, D. (2019). <u>How to teach critical thinking</u>. A paper commissioned by NSW Department of Education. Willingham goes so far as to suggest (p11) that 'We are not even sure that the general skills exist ...'

²⁸ Ministry of Education. (2022). *Literacy & communication and maths strategy*. Retrieved from https://assets.education.govt.nz/public/Documents/Ministry/Changes-in-education/ELS-0778-Maths-and-Literacy-Strategies-Doc web.pdf

In a nutshell

Within the Understand–Know–Do structure all components work together. The enduring important ideas found within the **Understand** statements inform the underlying focus of the topics that are selected to give substance to the ideas and to bring them to life (**Know**) when drawing on a range of practices and strategies (the **Do**). As ākonga depth of knowledge increases so does their depth of understanding of the big ideas along with their sophistication in the use of the practices. In doing so ākonga can draw on this learning to progressively explore more complex topics.

References

- Barradell, S. (2013). The identification of threshold concepts: a review of theoretical complexities and methodological challenges. *Higher Education*, *65*(2), 265-276. doi:10.1007/s10734-012-9542-3
- British Colombia. *Curriculum Overview*. Vancouver, Canada Retrieved from https://curriculum.gov.bc.ca/curriculum/overview
- Crown. (2019). *Curriculum, Progress and Achievement Ministerial Advisory Group Background Paper: Clarify pathways for ākonga (student progress)*. Retrieved from
- Erickson, H. L. (2002). *Concept-based curriculum and instruction: Teaching beyond the facts.* Thousand Oaks: Corwin Press Inc.
- Hannon, Valerie & Peterson, Amelia (2021) *Thive: The Purpose of Schools in a Changing World*. Cambridge University Press.
- Harlen, W. (2015). Towards big ideas of science education. *School Science Review*, 97(359), 97–107.
- Harlen, W. et al (2015). *Working with the Big Ideas of Science Education*. <u>IAP: The Global Network of Science Academies</u>.
- Hwb. (2022). *Introduction to Curriculum for Wales guidance* Retrieved from https://hwb.gov.wales/curriculum-for-wales/introduction/#the-curriculum-for-wales-framework
- IEAN. (2020). *Policy Conversation Paper Learning Progression: Implications for Curriculum & Assessment*. Retrieved from iean-learner-progression-implications-dec2020v2.pdf
- Johnston, M., Wood, B. E., Cherrington, S., Boniface, S., & Mortlock, A. (2022). Representations of disciplinary knowledge in assessment: Associations between high school and university assessments in science, mathematics and the humanities and predictors of success. *Educational Assessment*, 1-21. doi:10.1080/10627197.2022.2088495
- McTighe, Jay & Wiggins, Grant (1999). *The Understanding by Design Handbook*. Alexandria, VA., ASCD.
- Meyer, J., & Land, R. (2003). Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practising within the disciplines. In C. Rust (Ed.), *Improving student learning Ten years on*. Oxford: OCSLD. Meyer, J., Land, R., & Baillie, C. (2010). *Threshold Concepts and transformational learning*: Brill.
- Milligan, A., & Wood, B. (2010). Conceptual understandings as transition points: making sense of a complex social world. *Journal of Curriculum Studies, 42*(4), 487-501. doi:10.1080/00220270903494287
- Ministry of Education. (2022). *Literacy & communication and maths strategy*. Retrieved from https://assets.education.govt.nz/public/Documents/Ministry/Changes-ineducation/ELS-0778-Maths-and-Literacy-Strategies-Doc web.pdf
- Nuthall, Graham (2007). The Hidden Lives of Learners. Wellington, NZCER Press.
- OECD. (2005). *The definition and selection of key competencies: Executive summary*. Paris: OECD Retrieved from
 - http://www.pisa.oecd.org/dataoecd/47/61/35070367.pdf

- OECD. (2019). *Learning Compass 2030*. Retrieved from https://www.oecd.org/education/2030-project/teaching-and-learning/learning-compass-2030/
- Perkins, D. N. (2014). *Future wise: Educating our children for a changing world* (First ed. ed.). San Francisco, CA: Jossey-Bass & Pfeiffer Imprints, Wiley.
- Priestley, M., & Sinnema, C. (2014). Downgraded curriculum? An analysis of knowledge in new curricula in Scotland and New Zealand. *The Curriculum Journal*, *25*(1), 50-75. doi:10.1080/09585176.2013.872047
- Sinnema, C. (2015). The ebb and flow of curricular autonomy: Balance between local freedom and national prescription in curricula. In D. Wyse, L. Hayward, & J. Pandya (Eds.), *The Sage Handbook of Curriculum, Pedagogy and Assessment*. London: Sage.
- Sinnema, C., & Aitken, G. (2013). Emerging international trends in curriculum. In M. Priestley & G. Biesta (Eds.), *Reinventing the curriculum: New trends in curriculum policy and practice* (pp. 114-131). London: Bloomsbury.
- Stern, J., Ferraro, K., & Mohnkern, J. (2017). What are the essential elements of concept-based curriculum design? In J. Stern, K. Ferraro, & J. Mohnker (Eds.), *Tools for teaching conceptual understanding, secondary: Designing lessons and assessments for deep learning* (pp. 9-28): Corwin.
- Wiggins, Grant & McTighe, Jay (2005). Understanding by Design (Expanded 2nd Edition). Upper Saddle River: Pearson
- Willingham, D. (2019). *How to teach critical thinking*. Retrieved from State of New South Wales:
 - http://www.danielwillingham.com/uploads/5/0/0/7/5007325/willingham 2019 nsw critical thinking2.pdf
- Wilson, A., McNaughton, S., & Zhu, T. (2017). Subject area literacy instruction in low SES secondary schools in New Zealand. *Australian Journal of Language and Literacy, The,* 40(1), 72-85.
- Wood, B. E., & Sheehan, M. (2012). Dislodging knowledge? The New Zealand Curriculum in the 21st century. *Pacific-Asian Education*, *24*(1), 17-30.
- Wood, B. E., & Sheehan, M. (2021). Transformative disciplinary learning in history and social studies: Lessons from a high autonomy curriculum in New Zealand. *The Curriculum Journal*, *32*(3), 495-509. doi:https://doi.org/10.1002/curj.87
- Zohar, A., & Hipkins, R. (2018). How 'tight/loose' curriculum dynamics impact the treatment of knowledge in two national contexts. *Curriculum Matters*, *14*, 31-47.